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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
AS INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

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Applicant(s): C.R. BARD, INC. ET AL.
Title: JUNCTION OF CATHETER TIP AND ELECTRODE

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RESPONSE TO WRITTEN OPINION
AMENDMENT UNDER PCT ARTICLE 34(2)(b)

In response to the Written Opinion mailed 1 September 2004, Applicant respectfully requests reconsideration of the above-identified application by the International Preliminary Examining Authority in view of the following remarks and amendments to the claims under PCT Article 34(2)(b). Please substitute the enclosed sheet labeled as pages 13-18 for original pages 13-18, and consider the pages filed herewith to establish the International Preliminary Examination Report.

Per this amendment, originally filed claims 1, 2, 3, 7, 8, 9, 10, 11, 13, 14, 19, and 35 have been amended. Claim 20 has been canceled. No new claims have been added.

Claims 1-35 are now pending in the application. Currently pending claim numbers 1-19 correspond to originally filed claim numbers 1-19. The chart below shows the correspondence of originally filed claim numbers 21-36 to currently pending claim numbers 20-25.

Originally Filed Claim Number	Corresponding Current Claim Number
21	20
22	21
23	22

24	23
25	24
26	25
27	26
28	27
29	28
30	29
21	30
32	31
33	32
34	33
35	34

REMARKS

Applicant has amended currently pending claims 1, 2, 3, 7, 8, 9, 10, 11, 13, 14, 19, and 34 to more particularly point out and claim the invention. Claim 1 has been amended to recite, *inter alia*, that the exposed electrode surface forms a channel with the insulating material, the exposed electrode surface of the first diameter portion forms a base of the channel and the exposed electrode surface of the second diameter portion forms a sidewall of the channel. Amended claim 1 also recites that the sidewall forms an angle of less than 120 degrees with the channel base. Support for the claim language added by this amendment may be found at p.11, lines 3-9 and p.9, lines 9-14 of the application, and in originally filed dependent claim 20.

Prior art document D1 (U.S. Patent No. 6,514,246 B1) does not disclose a second diameter portion that forms a sidewall which in turn forms an angles of less than 120 degrees with the channel base.

Claims 3, 7-11, 13 and 14, each of which depends directly or indirectly from claim 1, have been amended to avoid potential lack of antecedent basis issues.

Independent claim 19 has been amended to incorporate the limitation of now canceled dependent claim 20. Amended claim 19 recites that the second sidewall forms an angle of less than 120 degrees with the channel base.

Independent claim 34 has been amended to recite that the transition face forms an angle of less than 120 degrees with the base. Support for the claim language added by the amendment to claim 34 may be found at p.11, lines 3-9 of the application and in originally filed dependent claim 20.

In response to Item III of the Written Opinion, Applicant would like to point out that each independent claim is distinct and each independent claim also is clear and concise. While the application is directed generally to various embodiments of a junction of a catheter shaft and an electrode, and methods of manufacturing a junction tip, each independent claim is distinct.

Claim 1 is directed to a catheter that comprises a catheter shaft having an insulating material and a diameter, and an ablation electrode forming a junction with the shaft, the ablation electrode having an exposed surface. Extending from the junction, the exposed electrode surface forms a channel with the insulating material and has a first diameter portion with a first diameter that is smaller than the shaft diameter, the first diameter portion forming an angle with the insulating material. The exposed electrode surface has a second diameter portion with a second diameter that is larger than the first diameter of the first diameter portion, the second diameter portion having a largest diameter that is smaller than a length of the second diameter portion. The exposed electrode surface of the first diameter portion forms a base of the channel and the exposed electrode surface of the second diameter portion forms a sidewall of the channel. The sidewall forms an angle of less than 120 degrees with the channel base.

Claim 19 is directed to a catheter comprising a shaft including an electrically insulating material, and an ablation electrode forming a junction with the insulating material and having an exposed surface that forms a channel with the insulating material. A base of the channel is the exposed electrode surface of a first diameter portion of the electrode, a first sidewall of the channel is the insulating material, a second sidewall of the channel is the exposed electrode surface of a second diameter

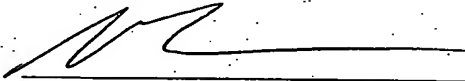
portion of the electrode, and a length of the second diameter portion of the electrode is greater than a diameter of the second diameter portion. The second sidewall forms an angle of less than 120 degrees with the channel base.

Claim 31 is directed to a catheter comprising a catheter having an insulating sheath, and an ablation electrode non-moveably attached to the insulating sheath, forming a junction with the insulating sheath, and having an exposed surface that forms a channel with the insulating sheath. A base of the channel is the exposed electrode surface, a first sidewall of the channel is the insulating sheath, a second sidewall of the channel is the exposed electrode surface, and a width of the base of channel is at least one-tenth of the size of the largest diameter of the electrode and less than the smallest diameter of the electrode.

Claim 34 is directed to a method of manufacturing a catheter tip, the method comprising providing a catheter shaft with an insulating sheath, providing an ablation electrode having a first diameter portion with an exposed surface and a second diameter portion with an exposed surface, the first and second diameter portions forming a transition face, and the second diameter portion having a length that is larger than a largest diameter of the second diameter portion. The method further comprises attaching the electrode to the shaft, wherein the transition face and the sheath form sidewalls of a channel and the first diameter portion of the electrode forms a base of the channel, and the transition face forms an angle of less than 120 degrees with the base.

A favorable International Preliminary Report on Patentability in response is requested.

Respectfully submitted,



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CLAIMS

1. A catheter comprising:
a catheter shaft having an insulating material and a diameter; and
an ablation electrode forming a junction with the shaft, the ablation electrode having an exposed surface;
wherein, extending from the junction, the exposed electrode surface forms a channel with the insulating material and has a first diameter portion with a first diameter that is smaller than the shaft diameter, the first diameter portion forming an angle with the insulating material;
wherein the exposed electrode surface has a second diameter portion with a second diameter that is larger than the first diameter of the first diameter portion, the second diameter portion having a largest diameter that is smaller than a length of the second diameter portion;
wherein the exposed electrode surface of the first diameter portion forms a base of the channel and the exposed electrode surface of the second diameter portion forms a sidewall of the channel; and
wherein the sidewall forms an angle of less than 120 degrees with the channel base.
2. The catheter according to claim 1, wherein the sidewall forms an approximately 90 degree angle with the channel base.
3. The catheter according to claim 1, wherein the channel allows blood to flow across the first diameter portion and the sidewall when the electrode is placed in a blood flow.
4. The catheter according to claim 1, wherein the ablation electrode further comprises a plurality of recessed regions that allow blood to flow across exposed surfaces of the recessed regions when the electrode is placed in a blood flow.

5. The catheter according to claim 1, wherein the ablation electrode is a distal tip ablation electrode.

6. The catheter according to claim 1, wherein the ablation electrode is a ring ablation electrode.

7. The catheter according to claim 2, wherein the sidewall forms an approximately 90 degree angle with the exposed surface of the second diameter portion.

8. The catheter according to claim 2, wherein the distance from the insulating material to the sidewall along the first diameter portion is larger than 0.3 millimeters.

9. The catheter according to claim 1, wherein the distance from the insulating material to the sidewall along the first diameter portion is less than the diameter of the first diameter portion.

10. The catheter according to claim 1, wherein the distance from the insulating material to the sidewall along the first diameter portion is approximately 0.9 millimeters.

11. The catheter according to claim 1, wherein the sidewall extends at least 0.3 millimeters toward a center longitudinal axis of the electrode from the exposed surface of the electrode.

12. The catheter according to claim 2, wherein the recessed region encircles the ablation electrode.

13. The catheter according to claim 1, wherein a largest diameter of the electrode is no larger than a diameter of the insulating material at the junction of the shaft and the electrode.

14. The catheter according to claim 1, wherein the sidewall is parallel to a distal end of the catheter shaft.

15. The catheter according to claim 1, wherein the first diameter portion and the insulating material form an angle of approximately 90 degrees.

16. The catheter according to claim 1, wherein the first diameter portion and the insulating material form an angle of more than 90 degrees.

17. The catheter according to claim 1, wherein the first diameter portion and the insulating material form an angle less than 90 degrees.

18. The catheter according to claim 1, wherein the ablation electrode is approximately four millimeters in length.

19. A catheter comprising:
a shaft including an electrically insulating material; and
an ablation electrode forming a junction with the insulating material and having an exposed surface that forms a channel with the insulating material; wherein
a base of the channel is the exposed electrode surface of a first diameter portion of the electrode;
a first sidewall of the channel is the insulating material;
a second sidewall of the channel is the exposed electrode surface of a second diameter portion of the electrode;
a length of the second diameter portion of the electrode is greater than a diameter of the second diameter portion; and

the second sidewall forms an angle of less than 120 degrees with the channel base.

20. The catheter according to claim 19, wherein the channel allows blood to flow across the channel base and the second sidewall when the electrode is placed in a blood flow.

21. The catheter according to claim 19, wherein the ablation electrode further comprises a plurality of channels that allow blood to flow across exposed surfaces of the channels when the electrode is placed in a blood flow.

22. The catheter according to claim 19, wherein the ablation electrode is a distal tip ablation electrode.

23. The catheter according to claim 19, wherein the ablation electrode is a ring ablation electrode.

24. The catheter according to claim 19, wherein the second sidewall forms an approximately 90 degree angle with the channel base.

25. The catheter according to claim 19, wherein the distance from the first sidewall to the second sidewall along the base is more than 0.3 millimeters.

26. The catheter according to claim 19, wherein the distance from the first sidewall to the second sidewall along the base is less than a diameter of the first diameter portion.

27. The catheter according to claim 19, wherein the second sidewall extends at least 0.3 millimeters toward a center longitudinal axis of the electrode from an outer surface of the electrode.

28. The catheter according to claim 19, wherein the channel encircles the ablation electrode.

29. The catheter according to claim 19, wherein a largest diameter of the electrode is no larger than a diameter of the insulating material forming the first sidewall.

30. The catheter according to claim 19, wherein the ablation electrode is approximately four millimeters in length.

31. A catheter comprising:
a catheter having an insulating sheath; and
an ablation electrode non-moveably attached to the insulating sheath, forming a junction with the insulating sheath, and having an exposed surface that forms a channel with the insulating sheath; wherein
a base of the channel is the exposed electrode surface;
a first sidewall of the channel is the insulating sheath;
a second sidewall of the channel is the exposed electrode surface; and
a width of the base of channel is at least one-tenth of the size of the largest diameter of the electrode and less than the smallest diameter of the electrode.

32. The catheter according to claim 31, wherein the electrode is a distal tip electrode.

33. The catheter according to claim 31, wherein the electrode is a ring electrode.

34. A method of manufacturing a catheter tip, comprising:
providing a catheter shaft with an insulating sheath;
providing an ablation electrode having a first diameter portion with an exposed surface and a second diameter portion with an exposed surface, the first and

second diameter portions forming a base and a transition face, and the second diameter portion having a length that is larger than a largest diameter of the second diameter portion; and

attaching the electrode to the shaft, wherein the transition face and the sheath form sidewalls of a channel and the first diameter portion of the electrode forms a base of the channel, and the transition face forms an angle of less than 120 degrees with the base.

35. The method according to claim 34, wherein attaching the electrode to the shaft results in the base of channel being at least 0.9 millimeters wide from sidewall to sidewall.

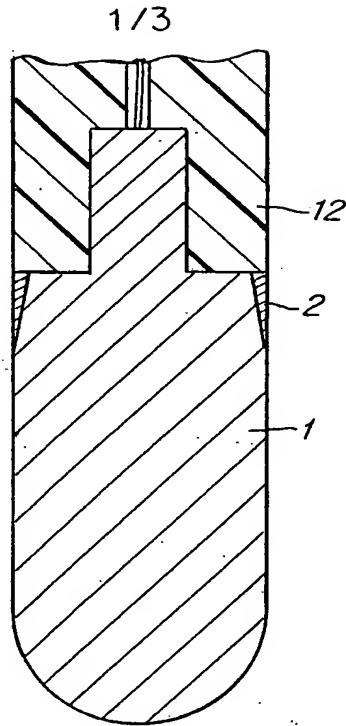


Fig. 1
PRIOR ART

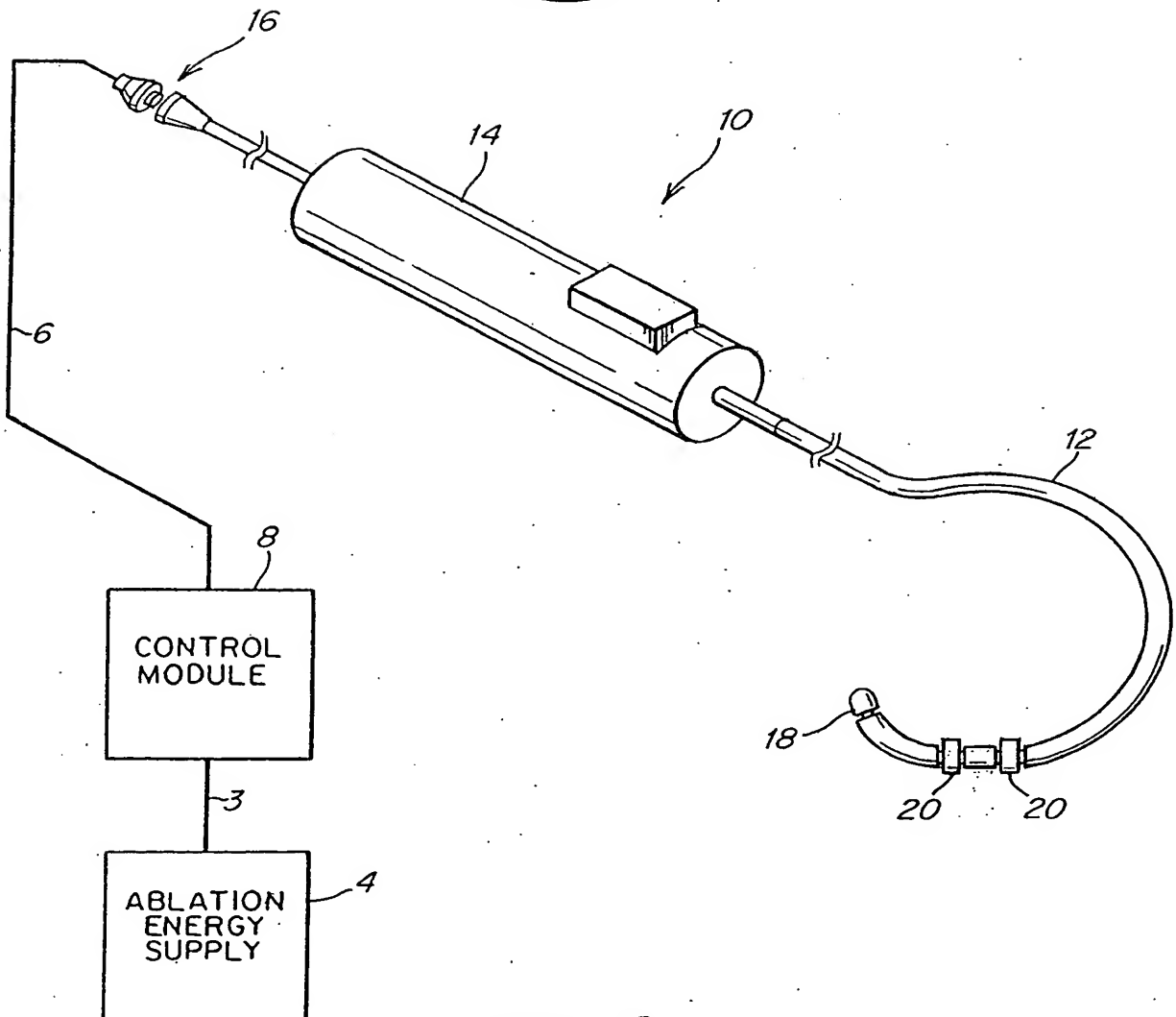


Fig. 2

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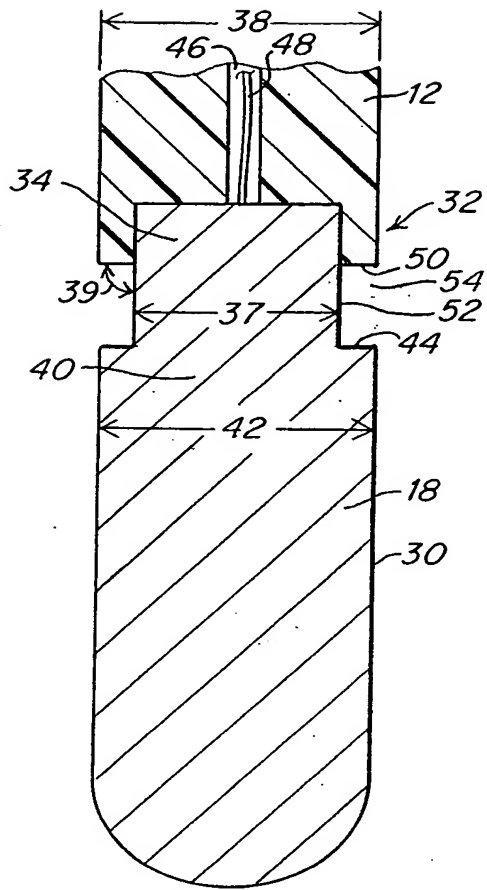


Fig. 3

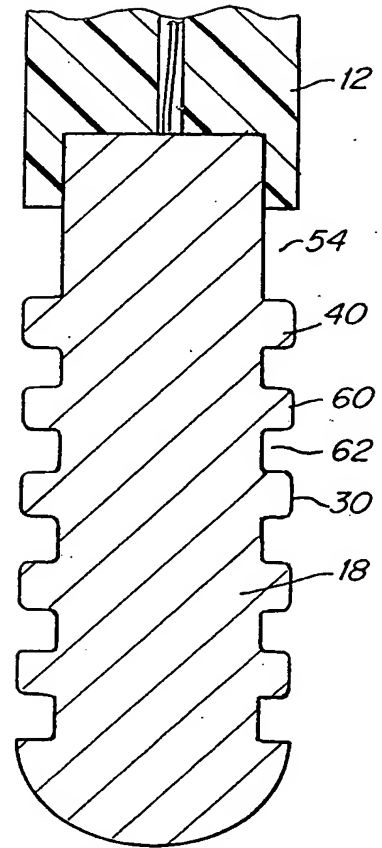


Fig. 4

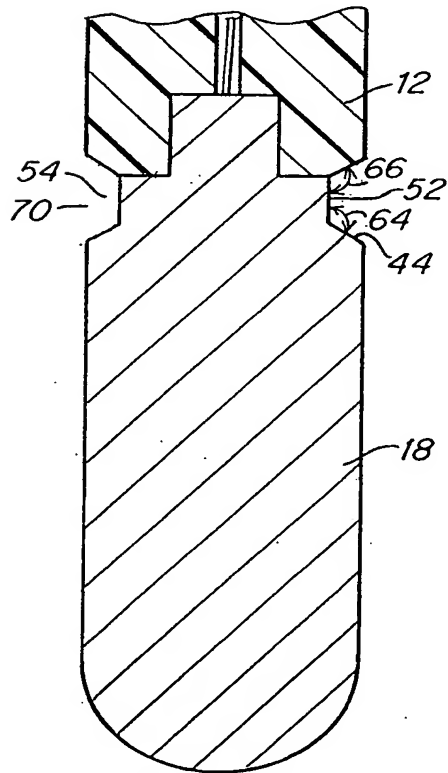


Fig. 5

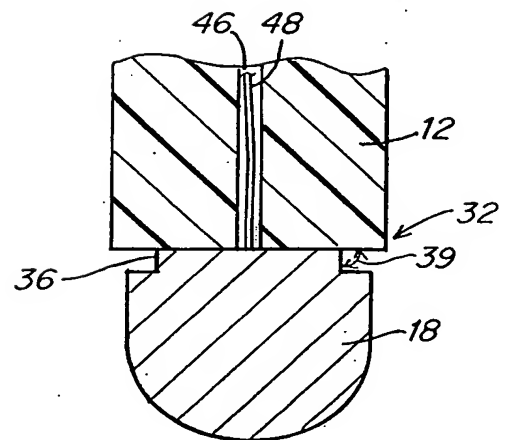


Fig. 6

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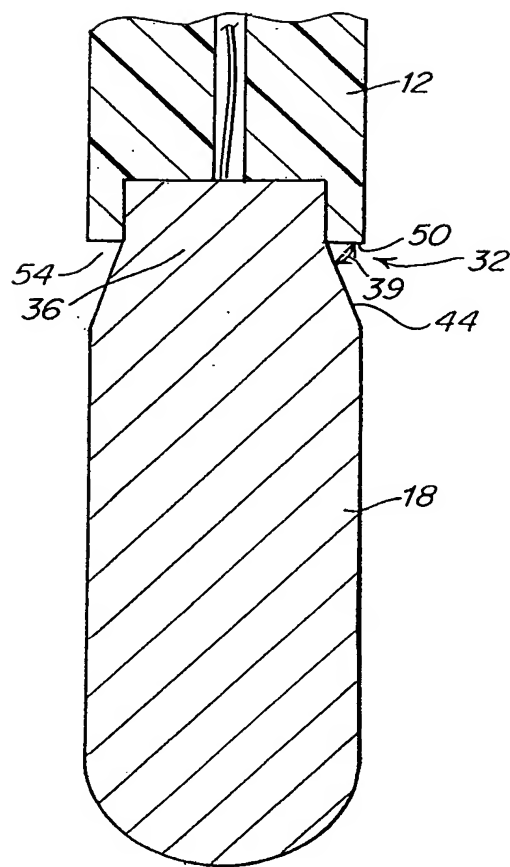


Fig. 7

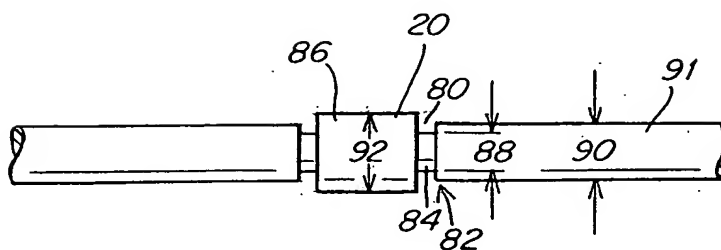


Fig. 8